

THE REQUIREMENTS DETERMINATION PROCESS
FOR MAJOR NAVAL WEAPON SYSTEMS:
A PROCEDURAL ANALYSIS

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Monterey, California



THESIS

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. by

Robert Lucius Jordan

September 1974

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The Requirements Determination Process
for Major Naval Weapon Systems:
A Procedural Analysis

by

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ABSTRACT

This thesis tracks the extensive evolutionary changes which have occurred in the DOD/Navy Requirements Determination Process during the period from 1970 to 1974. A functional model (which indicates the activities that should occur) in combination with an organizational model (which indicates the participants who should be involved) is used as a prescriptive baseline against which the actual procedures are analyzed and evaluated. Since most of the relevant procedures have been recently revised or replaced, the analysis begins with a review of those in effect prior to 1973 in order to illustrate several problems associated with them. The nature and origin of these problems are subsequently examined in detail. Next, the many changes which have been incorporated into the process are surveyed so that the currently existing procedures can be assessed in relation to the prescriptive baseline. Finally, the conclusions drawn from this evaluation are utilized as the basis for suggestions concerning further refinements to the process.

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GLOSSARY OF ACRONYMS

ACP - Area Coordinating Paper

ADO - Advanced Development Objective

ARC - Acquisition Review Committee

ASC - Advanced System Concept

CEB - CNO Executive Board

CNO - Chief of Naval Operations

CPAM - CNO Program Analysis Memorandum

CPPG - CNO Planning & Programming Guidance

DCP - Decision Coordinating Paper

DDPA&E - Director, Defense Program Analysis and Evaluation

DDR&E - Director, Defense Research and Engineering

DIA - Defense Intelligence Agency

DIPP - Defense Intelligence Projections for Planning

DNSARC - Department of the Navy System Acquisition Review
Council

DOD - Department of Defense

DPPG - Defense Policy and Planning Guidance

DSARC - Defense System Acquisition Review Council

EPA - Extended Planning Annex

EPG - Extended Planning Guidance

GAO - General Accounting Office

GOR - General Operational Requirement

JCS - Joint Chiefs of Staff

JIEP - Joint Intelligence Estimate for Planning

JLREID - Joint Long Range Estimative Intelligence Document

JLRSS - Joint Long Range Strategic Study
JRDOD - Joint Research and Development Objectives Document
JSOP - Joint Strategic Operational Plan
JSPS - Joint Strategic Planning System
MAS - Mission Area Summaries
MCP - Mission Concept Paper
NAC - Navy Advanced Concepts
NATO - North Atlantic Treaty Organization
NAVMAT - Naval Material Command
NDCP - Navy Development Concept Paper
NSC - National Security Council
NSDM - National Security Decision Memorandum
NSS - Navy Strategic Study
NSSM - National Security Study Memorandum
NTP - Navy Technological Projections
OPNAV - Office of the CNO
OR - Operational Requirement
OSD - Office of the Secretary of Defense
PPB - Planning, Programming, and Budgeting
PTA - Proposed Technical Approaches
R&D - Research and Development
SECDEF - Secretary of Defense
SOR - Specific Operational Requirement
STO - Science and Technology Objectives
TCP - Technology Coordinating Paper
TDP - Technical Development Plan
TSOR - Tentative Specific Operational Requirement

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I. INTRODUCTION

A. BACKGROUND

"The great technical complexity of modern-day weapons, their lengthy period of development, their tremendous combat power, and their enormous cost have placed an extraordinary premium on sound choices of major weapons systems..." [Ref. 15, p. 23].

These words from a 1965 article by C. J. Hitch have been echoed repeatedly in recent years as the General Accounting Office, the Blue Ribbon Defense Panel, and the Commission on Government Procurement all concluded that one of the most serious problems in the acquisition of major weapon systems is a failure to adequately identify needs and goals before embarking on new programs. Since most major acquisitions are initiated to provide replacements for existing systems, the specific requirements for them are too often assumed valid without a thorough investigation of their projected contribution to the overall force structure. Former Deputy Secretary of Defense David Packard suggested that this tendency to "think more in terms of what was effective in the last war rather than ... what might be needed for the future" is a primary cause of development difficulties, and he concluded that "no viable decision can be made on which weapons should be developed without knowing in considerable detail what kind of forces will be needed for the future" [Ref. 21, pp. 2,3]. The GAO has further commented that "Our study of the history of a fairly large sample of weapon systems leads us to conclude that the function of deciding which weapons

will be developed is not yet being done with the degree of effectiveness that this important function warrants" [Ref. 7, p. 71].

B. PURPOSE AND APPROACH

This thesis is the second half of a two-part study designed to ascertain an appropriate methodology for the determination of future requirements for major naval weapon systems. The first volume of the study [Ref. 16] was concerned solely with the problem of systematically identifying and analyzing several different types of procedures which should be included in the process. This volume, on the other hand, is aimed at tracking the extensive evolutionary changes which have been instituted in actual DOD/Navy requirements determination procedures during the 1973-74 time frame for the purpose of assessing their effectiveness in correcting prior difficulties.

A functional model (which indicates the activities that should occur) in combination with an organizational model (which indicates the participants who should be involved) is used as a prescriptive baseline against which actual DOD and Navy procedures are evaluated. Since most of relevant procedures have been recently revised or replaced, the discussion commences with a review of those in effect prior to 1973 in order to illustrate several problems associated with them. The nature and origin of these problems are subsequently examined in detail. Next, the many changes which have been incorporated into the process are surveyed so that the

currently existing procedures can be assessed in relation to the prescriptive baseline. Finally, the conclusions drawn from this evaluation are utilized as the basis for recommendations concerning further improvements to the process.

It should be emphasized that this thesis was not intended to provide a purely theoretical analysis and evaluation of DOD and Navy procedures. There are many practical problems involved in military requirements determination which would render such a treatment meaningless. The objective, therefore, was to conduct the analysis in a pragmatic manner that recognized the functional and organizational constraints which impact on these procedures and remained, insofar as possible, within realistic boundaries.

Finally, the author wishes to apologize for any inconvenience which a reader may experience due to the large number of acronyms used in the analysis. Since there are repeated references to a wide variety of DOD offices and documents with long titles, the use of at least some acronyms was virtually mandatory. A complete list of those used is provided in the front of the thesis in order to facilitate easy reference.

II. PRESCRIPTIVE BASELINE

A. FUNCTIONAL MODEL

This is a conceptual model which was developed by the author in the first volume of this study to identify the theoretical components of requirements determination and to delineate a systematic methodology for dealing with them. The model portrays the process as an iterative sequence of five decision points involving the following functions: formulation of military strategy; assessment of opposing forces; analysis of perceived deficiencies; synthesis of alternative solutions; and evaluation of solution concepts. Each of these functional decision points utilizes the output of the previous function as an input so that an orderly sequence of operations is maintained. A flow chart of the model is depicted in figure 1 and serves as the basis for the following discussion.

The first function encountered in the model is FORMULATION. This is the process of equating national security objectives with existing defense capabilities in order to develop appropriate military strategies, where strategies are defined as the means by which capabilities are utilized to pursue objectives. Naturally, the projected global environment (including relevant physical, political and cultural factors) is a vital consideration in this development.

The next function is ASSESSMENT. Its purpose is to evaluate military strategy in light of the specific threat posed

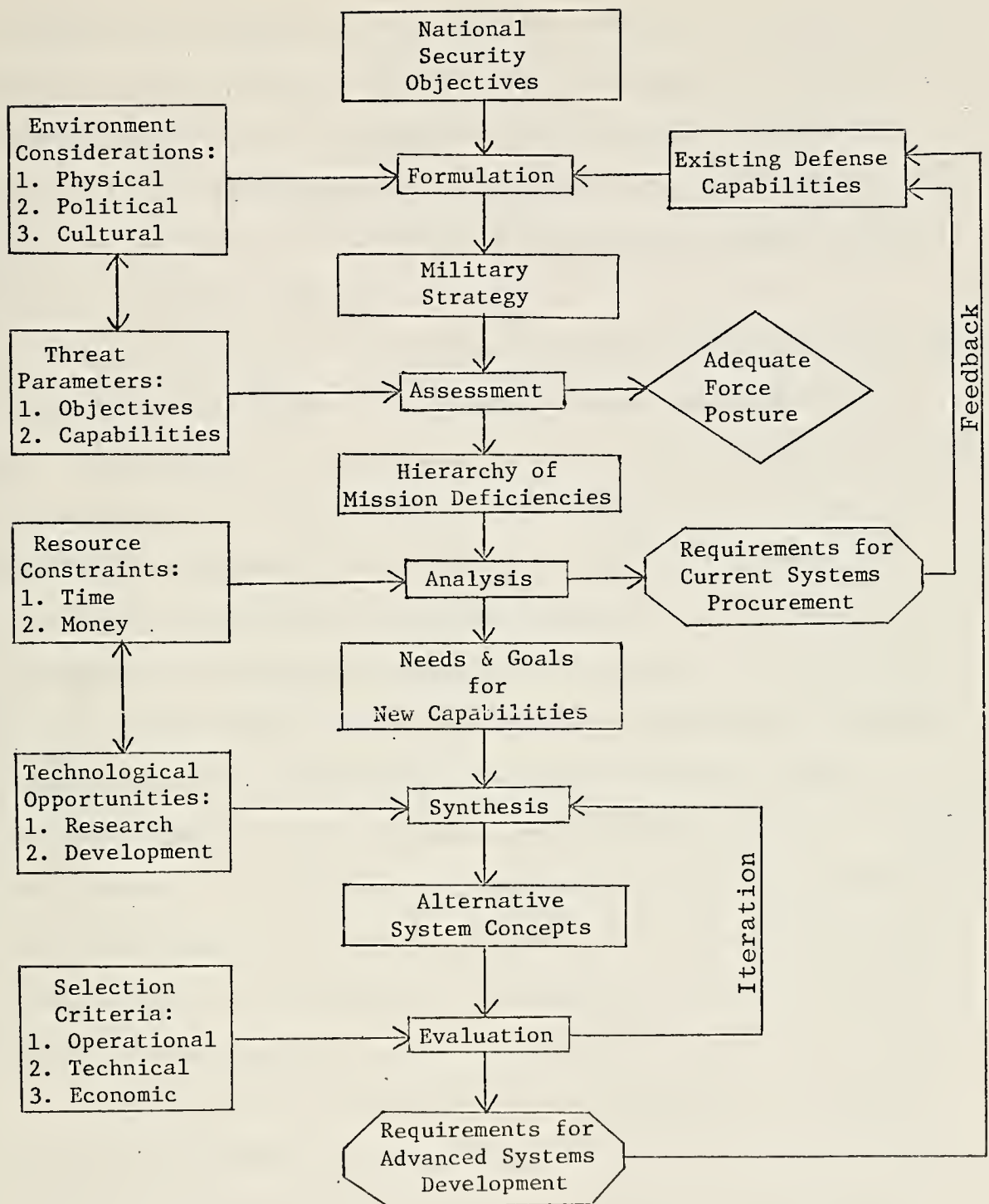


Figure 1. Functional Model Flow Chart

by potential enemies in order to determine if existing capabilities are sufficient for the accomplishment of national objectives. If so, an adequate force posture exists and there are no requirements for additions or improvements. If this is not the case, however, a hierarchy of deficiencies is the resultant output.

The deficiencies thus delineated should then be subjected to in-depth ANALYSIS. The objective here is to determine, both qualitatively and quantitatively, what capabilities need to be augmented in order to correct these deficiencies and whether the necessary correction is best accomplished by additional procurement of current systems or development and deployment of advanced systems (i.e. a more or better decision). This determination is greatly influenced by the constraints of both time and money since new developments generally require more planning and resources than do current procurements. If additional forces are indicated, plans for procuring them should be initiated. If, on the other hand, improvements are necessary, a delineation of the relevant capability performance goals is appropriately the next step.

The fourth function involves the SYNTHESIS of alternative system concepts in response to the needs and goals derived from the foregoing analysis. The driving forces in this process are existing research and development opportunities, where research connotes what is thought to be feasible while development refers to what is known to be feasible. The nature of such opportunities is, of course, influenced by the same time and money constraints mentioned previously.

The final function in the model is EVALUATION. This function involves the consideration and comparison of the synthesized concepts in light of three important criteria: operational practicality, technical feasibility, and economic affordability. If none of the concepts is acceptable, the process becomes iterative and new concepts must be synthesized until one or more is accepted. When that occurs, the validated concepts can be expressed as requirements for advanced systems development and the cycle, but not the process, is complete.

In order for this process to reach true completion, an adequate force posture must be achieved. Therefore, the entire procedure is implicitly iterative in that the procurement or development requirements evolved in each cycle must be fed back as an adjustment to existing capabilities. If the subsequent formulation and assessment indicate that an adequate force posture has been achieved, the additions or improvements generated by the previous iteration are sufficient. If not, the process must continue to generate further requirements until such is the case.

It should be noted that this conceptual model is intentionally extremely simplified and generalized. It was designed solely as a prescriptive procedural outline, not as the exact representation of an operational process. Although it may not be possible for a "real-world" process to be this definitized, the author contends that each of the elements and functions described here must be included in any effective one.

B. ORGANIZATIONAL MODEL

This model, also prescriptive in nature, was developed by the Commission on Government Procurement to delineate the relationships which should exist among Congress, OSD, the services, and industry as participants in the acquisition of major weapon systems [Ref. 6, Part C]. The summary chart depicted in figure 2 illustrates these relationships and forms the backdrop for the following discussion of the model.

The Commission viewed the individual services as the appropriate initiators of the systems acquisition process through identification and submission of projected deficiencies to the Office of the Secretary of Defense (OSD). The correct role of OSD then is to reconcile these specific deficiencies with overall Defense goals and determine appropriate resource constraints. Congress should have the function of conducting a general overview of mission capabilities and deficiencies.

Once needs and goals have been established by OSD and reviewed by Congress, it is the services' responsibility to solicit proposals from industry for satisfying them and to sponsor the preferred candidate solutions. These should be subsequently reviewed by OSD and submitted to Congress for exploration authorization.

The authorized exploration can then be conducted by industry; with the most promising and desirable system concepts to be evaluated by the services in order to determine which one(s) will be fully developed. The results of this

| | ESTABLISHING NEEDS & GOALS | EXPLORING ALTERNATIVE SOLUTIONS | CHOOSING PREFERRED SYSTEM |
|----------|---|---|------------------------------------|
| CONGRESS | Conduct Review of Deficiencies by Mission Area | Authorize R&D by Mission Area | Authorize System Development |
| OSD | Reconcile Deficiencies with overall Defense Capabilities & Assign | Review Sponsored Candidates | Validate Preferred System |
| SERVICE | Identify Mission Deficiencies | Solicit Proposals and Sponsor Likely Candidates | Choose Preferred System |
| INDUSTRY | No Involvement | Explore Alternative Concepts | Develop System |

Source: Report of the Commission on Government Procurement

Figure 2. Organizational Model Summary Chart

evaluation should be reviewed and validated by OSD and the chosen system submitted to Congress for development appropriation.

It is readily apparent from figure 2 and the foregoing discussion that the divisions of the organizational model (i.e. establishing needs and goals, exploring alternative systems, and choosing preferred system) correspond quite closely with the functional model activities of analysis, synthesis, and evaluation. It is necessary, therefore, to augment the "front end" of the organizational model with appropriate counterparts for the functions of formulation and assessment in order to complete the prescriptive baseline. The basis for this augmentation is provided by Title 10 of the United States Code and the National Security Act of 1947.

The National Security Council (NSC) is legally charged with the responsibility "to assess and appraise the objectives, commitments, and risks of the United States in relation to our actual and potential military power, in the interest of national security, for the purpose of making recommendations to the President in connection therewith" [Title 10, U.S. Code]. The DOD input to this task is provided by the Joint Chiefs of Staff (JCS) through the Secretary of Defense (SECDEF). The individual services, in turn, provide supplemental inputs concerning their own areas of designated mission responsibility. The activities of formulation and assessment in the functional model, therefore, may be viewed as being initiated by the services and the JCS,

subject to SECDEF guidance, NSC validation, and Presidential approval.

The "augmented" organizational model, in conjunction with the functional model, comprises the prescriptive baseline against which the DOD requirements determination procedures discussed in subsequent chapters are evaluated.

Figure 3 summarizes the various functional/organizational interfaces involved in this baseline in order to facilitate direct comparison with actual procedures.

| <u>FUNCTION</u> | <u>INITIATION AND/OR COORDINATION</u> | <u>GUIDANCE AND/OR VALIDATION</u> | <u>REVIEW AND APPROVAL</u> |
|---|---|---|------------------------------------|
| FORMULATION | SERVICES/JCS | OSD/NSC | PRESIDENT |
| ASSESSMENT | SERVICES/JCS | OSD/NSC | PRESIDENT |
| ANALYSIS (Establishing Need & Goals) | SERVICES | OSD | CONGRESS (Review Only) |
| SYNTHESIS (Exploring Alternative Systems) | SERVICES/ INDUSTRY | OSD | CONGRESS |
| EVALUATION (Choosing Preferred System) | SERVICES | OSD | CONGRESS |

Figure 3. Prescriptive Baseline Summary Chart Illustrating the Interfaces
Between the Functional and Organizational Models.



III. REVIEW OF PRE-1973 PROCEDURES¹

The DOD requirements determination process has often been described as the bridge between the Planning, Programming and Budgeting System (PPBS) and the R&D planning system. As such, it is composed of a complicated and somewhat confusing combination of procedures and documents from both systems. As noted in the introduction, many of these have been revised or replaced in the past two years. In order to develop the rationale for the extensive changes which have occurred, it is necessary to review the procedures and documents which preceeded them. The purpose of this chapter, therefore, is to delineate the process as it existed during the period prior to 1973.

In order to facilitate comparison with the prescriptive baseline, the discussion of the process has been broken down into the five functional categories described in the last chapter. While the chosen breakpoints may appear somewhat arbitrary, the author feels they are defensible on the grounds that they are intended solely as pedagogical aids.

Before proceeding with the review, two caveats are in order. First, although the discussion is conducted in the present tense, all references in this chapter are to pre-1973

¹ For the sake of simplicity, this review is primarily concerned with the formally documented procedures delineated in the Navy Programming Manual [Ref. 26] and the Navy RDT&E Management Guide [Ref. 1].

procedures. Second, since there has been a tremendous amount of variation in the evolution of individual requirements, the discussion covers what was generally supposed to occur rather than what actually happened in any specific case.

A. FORMULATION OF STRATEGY

As noted in the previous chapter, the legal responsibility for development of national security policy is vested in the NSC. Its findings and opinions are published in the form of National Security Study Memorandums (NSSM) which, when approved by the President, provide the basis for National Security Decision Memorandums (NSDM). These memorandums, in conjunction with intelligence estimates provided by the Defense Intelligence Agency (DIA), are used by the JCS as source documents in their formulation of military strategy. The formulation process itself is accomplished within the framework of the Joint Strategic Planning System (JSPS). In particular, Volume One of the Joint Strategic Objectives Plan (JSOP I) provides appropriate military strategy for the short and mid-range period (up to ten years in the future) in accordance with the national security objectives delineated by NSC plus environmental estimates contained in the Joint Intelligence Estimate for Planning (JIEP). This latter document describes various situations and developments that might affect U.S. defense capabilities and enumerates possible courses of action which might be taken by potential enemies.

The long range period (10-20 years) is covered by the Joint Long Range Strategic Study (JLRSS) which addresses the strategic implications of projected world-wide economic, political, social, and technical trends. Its primary environmental input is the recently instituted Joint Long Range Estimative Intelligence Document (JLREID) which summarizes factors and trends affecting world power relationships in the long-range period.

The specific implications for naval forces contained in both the JSOP and JLRSS are developed and amplified by the Navy Strategic Study (NSS) which covers the entire twenty-year range and summarizes current Navy roles and tasks as well as concepts for future Navy contributions to national defense.

B. ASSESSMENT OF FORCES

This function is performed concurrently by the JCS (in the development of JSOP, Volume Two) and the individual services. Its principal inputs are the strategy documents just described, the Defense Policy and Planning Guidance (DPPG), and detailed intelligence projections prepared by DIA. The most noteworthy of the latter is the Defense Intelligence Projections for Planning (DIPP) which contains military force projections for the Soviet Union (USSR) and the Peoples Republic of China (PRC).

While JCS assessments are primarily concerned with overall U.S. force requirements for coping with global military threats, assessment in the Navy is more oriented toward the

adequacy and effectiveness of specific capabilities. Normally performed by individual mission sponsors in accordance with the CNO Planning and Programming Guidance (CPPG), Navy assessments typically investigate the probability that, at some point in the future, a potential enemy will possess a particular capability of such size and/or sophistication that the relevant Navy capability will be too small, too old, or too primitive for successful engagement. When that probability is considered significant, a prospective deficiency is identified and analyzed in the sponsor's force planning documents (e.g. The Naval Aviation Plan) and the CNO Program Analysis Memoranda (CPAM).

C. ANALYSIS OF DEFICIENCIES

Once a prospective deficiency has been identified, the sponsor generally determines that it will require correction by accelerated procurement of current systems, modernization of older systems, or development of advanced systems -- depending on whether the deficiency is perceived to be the result of numbers, age, or obsolescence. Those deficiencies that are expected to involve extensive research and development (R&D) efforts are then delineated in statements of General Operational Requirements (GOR) which project the performance capability parameters which will be needed.

The R&D needs of all the services are monitored by the JCS through the Joint Research and Development Objectives Document (JRDOD). Its purpose is to translate the JLRSS and JSOP implications for future capability needs into specific

R&D objectives as an aid to SECDEF in the proper orientation of the overall Defense R&D program. The Director of Defense Research and Engineering (DDR&E) is concurrently involved in this effort through production of Area Coordinating Papers (ACP) and Mission Area Summaries (MAS). These documents are designed to provide SECDEF with a broad overview of each mission area by identifying existing or projected problems, describing current programs for dealing with them, and predicting the net impact of these programs on the future force structure.

D. SYNTHESIS OF ALTERNATIVES

The Naval Material Command (NAVMAT), the technical representative in the Navy requirements definition dialogue, develops Navy Technological Projections (NTP) as its initial response to GOR-specified deficiencies. This document supplies the mission sponsors in OPNAV with an outline of new or improved capabilities believed to be reasonably attainable in the foreseeable future. In a parallel role at the OSD level, DDR&E produces Technology Coordinating Papers (TCP) to provide the same type of information for SECDEF. These two documents are designed as tools in the process of refining broad need projections into more concrete development objectives.

Once a need has been fairly clearly defined by the mission sponsor, a Tentative Specific Operational Requirement (TSOR) is established and documented. It is the first step in the conception of a specific system requirement and serves

as a formal request from OPNAV to NAVMAT for the information necessary to define the scope of effort and resources required to achieve the particular capability it describes. It does not establish a firm requirement nor authorize commencement of a development program. It is designed merely to delineate a specific need, identify the operational capabilities necessary to satisfy the need, and request an investigation into the feasibility of providing those capabilities.

After a thorough examination of the relevant technological opportunities that are available, NAVMAT responds to the TSOR with Proposed Technical Approaches (PTA). These are documented by the appropriate systems commands as an outline of the various alternative means by which the required capabilities may be feasibly attained, including estimates of the costs and risks associated with each one. It is then the responsibility of the mission sponsor to determine if one or more of the concepts delineated in the PTA are adequate to fulfill the operational need.

E. EVALUATION OF CONCEPTS

Upon receipt of the PTA by the mission sponsor, a long and multi-level evaluation process is initiated. The first step is for the sponsor to decide if the PTA offers clearly useful concepts which can be developed under acceptable levels of technical and financial risk. If such is the case, a Specific Operational Requirement (SOR) can be established in order to formally state the need for a particular capability

and outline the system characteristics by which this capability is to be achieved. If it is not the case, however, the sponsor's response is an Advanced Development Objective (ADO) which delineates the need for experimental development of concepts which do not yet exhibit acceptable risk in the areas of military usefulness, technical feasibility, or economic acceptability. In either event, NAVMAT replies with a Technical Development Plan (TDP) which documents the specific actions, procedures, and resources necessary to achieve the required capability. This represents the final portion of the OPNAV-NAVMAT requirements definition dialogue and forms the information base for higher-level evaluation.

When a TDP has been submitted by NAVMAT and accepted by OPNAV, the mission sponsor (in coordination with the NAVMAT program manager) begins preparation of a Development Concept Paper (DCP). This document is designed as a coordinated management tool which provides the basis for SECDEF decisions on a major development program and serves as the instrument for decision implementation. As such, it is basically a contract between SECDEF and the cognizant service which governs the administration of the program.

When a draft DCP has been prepared for a particular development, it is submitted initially to the Chief of Naval Operations Executive Board (CEB) for a review of Navy issues and alternatives. Their recommendations, as validated by the CNO, are then incorporated by the sponsor into the DCP. The revised draft is next submitted to DDR&E for review and

comment prior to presentation to the Defense System Acquisition Review Council (DSARC). When the final draft has been agreed upon, it is presented by the sponsor at various levels within OPNAV and finally to the DSARC itself.

The purpose of the first DSARC review (DSARC I) is to ensure (from an OSD standpoint) that a valid need has been identified, that all viable alternatives for fulfilling it have been examined, and that the proposed system parameters are realistic in terms of risk and cost. When the DCP has been approved by the DSARC and signed by SECDEF, the system development is included as an element of the Five Year Defense Program (FYDP). Finally, during the congressional budget hearings, it is supported for funding by SECDEF, DDR&E, and CNO as well as other cognizant Navy officials.

The documents and relationships just described are illustrated in figure 4 in order to facilitate comparison with the prescriptive baseline summary depicted in figure 3 even though the organizational divisions of the two figures differ, the reader may note that they appear to be highly correlated. The objective of the next chapter is to demonstrate that, due to a number of problems involved with the pre-1973 procedures, their similarity to the prescriptive baseline is primarily a superficial one.

PRE-1973 PROCEDURAL RELATIONSHIPS

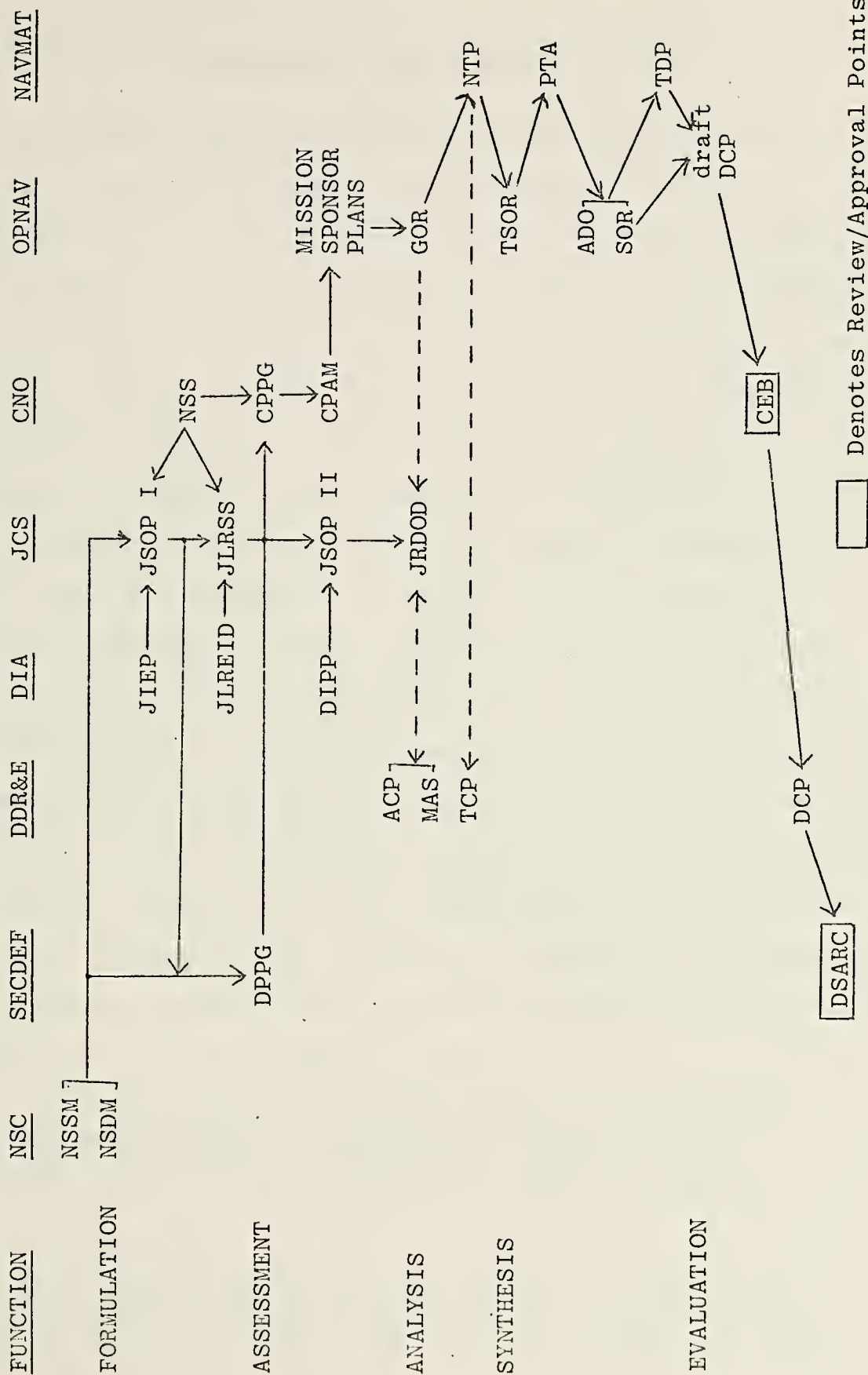


Figure 4

IV. EXAMINATION OF MAJOR PROBLEM AREAS²

It has been noted by various different authorities that most major system requirements are generated to provide replacements for existing systems without a sufficiently thorough analysis of their projected contribution to the overall force structure. In view of the discussion contained in the previous chapter, it is relevant to ask why this situation has repeatedly occurred when an apparently comprehensive process for conducting such analyses was in existence. This is the question which the following discussion attempts to answer through examination of several problems associated with the documented process. In order to develop an understanding of why these problems existed, it is necessary to place the process in historical perspective by delineating two major policy changes which contributed to their genesis.

Prior to 1961, requirements determination had traditionally been an individual service responsibility with coordination, as required, at the JCS level. When Robert S. McNamara became SECDEF, however, this situation changed rapidly and drastically. His approach was that:

"...either of two broad philosophies of management could be followed by a Secretary of Defense. He could play an essentially passive role -- a judicial role. In this role the Secretary would make

² This examination represents the author's personal opinions based on extensive interviews with cognizant DOD officials as well as a thorough study of References 2,4,5, 6,7,8, and 17.

the decisions required of him by law by approving recommendations made to him. On the other hand, the Secretary of Defense could play an active role providing aggressive leadership -- questioning, suggesting alternatives, proposing objectives, and stimulating progress. This active role represents my own philosophy of management." [Ref. 8, p. 2].

In implementing this philosophy, he instituted the now well-known PPB System and augmented it with a base of sophisticated analytic support at the OSD level. The Assistant Secretary of Defense for Systems Analysis, Alain Enthoven, quickly became one of the most powerful men in DOD. He and his staff took on a pre-eminent role in the requirements determination process and were deeply involved in the definition of major system concepts during their tenure of office.

In 1969, Melvin Laird was appointed SECDEF with David Packard as his Deputy. These individuals viewed with alarm the spiraling costs and technical difficulties being experienced by several of the major systems (such as the C5A) initiated under the McNamara regime, and they attributed much of the origin of these problems to McNamara's emphasis on centralized analysis and control. Their solution was a new era of participatory management in which the "aim is to improve both the decision-making process and also other management activities by placing more emphasis on people and less emphasis on elaborate procedures" [Ref. 9, p. 113]. This philosophy provided the rationale for DODD 5000.1, "Acquisition of Major Defense Systems", which delineates the roles of the services and OSD in the acquisition process. It basically states that the individual services are responsible

for the orderly identification and development of major system requirements subject to OSD review and approval at three crucial decision points: program initiation, full scale development, and production/deployment. The Navy, in turn, amplified DODD 5000.1 with SECNAVINST 5000.1 which extends the identification and development responsibilities down to the individual mission sponsor and program manager level, with the CNO and SECNAV in an intermediate review and validation role.

With the foregoing historical perspective in mind, it is now possible to examine more clearly the problems associated with the process described in the last chapter. Again, the discussion is conducted in the context of the functional model divisions in order to facilitate comparison with the prescriptive baseline.

A. FORMULATION OF STRATEGY

The procedures involved here are the development of the NSSM's by the NSC, the JLREID and JIEP by DIA, the JLRSS and JSOP I by JCS, and the NSS by OPNAV. The problem is basically long-range in nature and results from the inadequate specificity of future projections. While most of the short and mid-range documents involved in strategy formulation were detailed, comprehensive, and widely utilized, the long-range ones (JLREID, JLRSS, NSS) were not. Unfortunately, these latter documents are vital to the orderly development of major system requirements since the normal lead times involved in early conceptual efforts range from five to fifteen

years. The long-range documents were usually so vague and general in nature that they were almost useless in force structure planning. The primary difficulty was the lack of appropriate techniques for developing objective forecasts of the future. In their absence, subjective projection of currently perceived trends was the principal tool of long-range strategy formulation. An embarrassing and wasteful consequence was the genesis of system concepts which were frequently obsolete before they were ever deployed.

B. ASSESSMENT OF FORCES

The problems involved in this function stem primarily from those just discussed. Since the analysts performing assessments did not have a well-defined strategy base on which to establish their projections of either force in a long-range environment, they normally developed their own initial assumptions. The predictable result was that assessments generally reflected the parochial positions of the originators rather than an objective comparison of opposing forces. This situation was compounded by the fact that Navy assessments were performed predominantly at the mission sponsor level, which made it extremely difficult to compare and relate perceived deficiencies in either a Navy-wide or DOD-wide context. While the planning guidance injected by the DPPG and CPPG might have at least partially ameliorated the problem, it was too broad in scope to be effective.

C. ANALYSIS OF DEFICIENCIES

The problems noted previously created a real "snowball effect" at this point. Since individual sponsors were basically responsible for identifying their own deficiencies, it was only natural that they would assume that replacements or additions composed of similar type weapons would be required. In fact, it is unrealistic to assume that they would ever seriously suggest that the deficiency might be most appropriately corrected by some type of system not under their purview. Also, since their primary concern was typically the replacement of existing systems, they frequently viewed the problem more in terms of what they could get than what they really needed (i.e. in the absence of even moderately clear projections of deficiencies, what is technically achievable becomes much simpler to define than what is required to perform the relevant mission). Therefore, those deficiencies which were easily definable tended to evolve quickly into specific system requirements while those which were more distant and/or elusive were frequently addressed in only the most general terms. As a result, the formal procedures for providing initial direction to early exploratory development efforts were often either ignored or utilized only for record-keeping purposes. The rationale was that the GOR's were too general to be useful as guidance to the R&D community and the effort required to write them was, therefore, disproportionate to their value.

Thus, the established procedure for delineating long-range needs fell into disuse by both sides of the requirements definition dialogue and was replaced by an informal and substantially undocumented exchange of information between the parties concerned. While this arrangement was quite convenient and useful at the working level, it created difficulties for the higher level officials who were responsible for coordination and control of the overall deficiency analysis function. Within the Navy, control and coordination were constrained by the fact that the relevant time frames were normally beyond the horizon of PPBS-oriented analyses. Similarly, at the OSD level, the effectiveness of both the JRDOD and the ACP's as coordination tools was reduced by unavailability of well-documented deficiency information. In fact, the JRDOD became little more than a collection of uncorrelated needs perceived by each separate service. The newly instituted ACP's, on the other hand, evolved into a set of documents that were almost exclusively concerned with ongoing development programs which were already past the point where they could be re-directed or dropped without significant sacrifices of money and/or time. Furthermore, the lack of adequate long-range analyses at the CNO or SECDEF levels rendered meaningful review of needs by Congress virtually impossible. While some critics of DOD contend that the results of such analyses would not have been voluntarily provided to Congress in any event, the fact remains that they simply were not readily available.

In summary, the deficiency analysis portion of the requirements determination process was grossly inadequate prior to 1973. As a result of the new participatory management policies, this function had been delegated to individual mission sponsors. Faced with insufficient guidance, coupled with understandably parochial perspectives, they normally developed self-perpetuating analyses of needs. Because of rather primitive analytic capabilities, these needs tended to be phrased in extremely vague terms unless they could be defined by specific system parameters. As a result, the formally documented procedure for stating long-range needs was supplanted by an informal working level dialogue between the user and producer. Consequently, review and control by higher authority was greatly hampered due to the absence of objective and comprehensive analyses.

D. SYNTHESIS OF ALTERNATIVES

As a result of the informal dialogue established between OPNAV sponsors and NAVMAT managers, the formal exchange of documents outlined in the synthesis section of the last chapter was often totally by-passed. The principal reason appears to be that the procedure, while quite logical and orderly on paper, was extremely cumbersome and time-consuming in practice. The documents involved were considered to be overly detailed, partially duplicative, difficult to process, and frequently unnecessary. As a result, they were seldom published except for the purpose of providing an after-the-fact summary of activities and decisions. Since

it was consequently difficult to maintain any positive control above the working level, viable alternatives for satisfying a particular need could easily be disguised or eliminated without fear of serious repercussions. DDR&E attempted to remedy the situation through the initiation of TCP's but the impact of this fledgling effort was minimal prior to 1973. Also, the influence of Congress over this phase of the process was severely hampered by the fact that the budget request for R&D was submitted and supported in terms of fiscal appropriation categories rather than operational mission areas.

E. EVALUATION OF CONCEPTS

The informal dialogue between OPNAV and NAVMAT which was described in the two previous sections generally terminated with the agreement on a particular system approach and was frequently documented by the almost simultaneous production of an SOR and TDP. Even these documents, however, did not often reach publication before the system was well into engineering development due to numerous processing delays within the bureaucracy.

The remainder of the evaluation activities usually proceeded in the manner described except that both the CEB and DSARC program initiation reviews were often delayed. DCP production difficulties were often cited as the principal cause of delay, but there is reason to believe that political/bureaucratic considerations played a large part in the timing of these reviews. At any rate, delay past the appropriate program initiation decision point almost always had

the effect of reducing the viable decision options available to the review panels and, therefore, degraded the effectiveness of their important validation role. Congress, as the final authority in the process, was also hampered by delays. On several occasions, development budget requests were delayed until the point where significant costs in time, money, or readiness would almost surely result if the requested funds were not promptly appropriated.

In conclusion, the major problems which were involved in the pre-1973 formally documented process may be grouped into three broad categories: direction and coordination; execution and documentation; review and control.

Most of the problems associated with direction and coordination can be traced, either directly or indirectly, to the vacuum that was created when centralized analysis and control was replaced by participatory management. When DODD 5000.1 and SECNAVINST 5000.1 moved the bulk of the analytic responsibilities for requirements determination from the OSD level to the mission sponsor level, neither DDR&E nor the CNO were adequately prepared to supply the direction and coordination which had previously been exercised by OASD Systems Analysis on behalf of SECDEF. Consequently, the individual mission sponsors were given a great deal of analytic latitude which they tended to utilize in a predictably parochial manner.

The problems associated with execution and documentation, on the other hand, are mostly products of two basically unrelated phenomena: the uncertainty inherent in long-range

projections and the inflexibility inherent in standardized procedures. While the process described in the last chapter appears to correspond very closely with the prescriptive baseline, the fact that it was keyed to a complex progression of many voluminous documents made it virtually unmanageable. Several of the documents involved suffered from inadequate preparation and burdensome processing and, as a result, were often by-passed in favor of informal dialogues. While working level communication and performance were enhanced by this arrangement, supervisory level functions were severely degraded.

Finally, the major problems associated with review and control are predominantly bureaucratic or political in nature. From the standpoint of the organization being evaluated or controlled, the normal objective is to minimize outside interference as much as possible. At each level of review, from the CEB to the Congress, it is therefore quite natural for the sponsoring organization to constrain the options of the reviewer as tightly as possible to the sponsor-preferred alternative.

Regardless of how the various problems originated, they all resulted in a relatively inefficient process which wasted valuable resources and degraded future military readiness. The next chapter describes and analyzes a variety of new procedures which have recently been instituted to correct this undesirable situation.

V. SURVEY OF RECENT PROCEDURAL CHANGES³

The problems noted in the last chapter have prompted the initiation of procedural revisions throughout DOD. While many of these problems have been recognized and analyzed for several years, it was not until publication of the Report of the Commission on Government Procurement in 1972 that the impetus for change really gained momentum. Consequently, major revisions to the process have been implemented only in the last two years even though many of them originated with the 1970 introduction of the Laird-Packard participatory management philosophy into DOD.

A. FORMULATION OF STRATEGY

It has been noted that the major problems associated with the formulation of military strategy resulted primarily from the extreme generality and vagueness of the relevant long-range planning documents. In response to these problems, JCS and DIA initiated an in-depth study to determine what improvements could be made. Specifically, three well-known research centers (i.e. Hudson Institute, Consolidated Analysis Center, and the Institute for Defense Analyses) were commissioned to develop new methodologies for production of

³ This survey is based on interviews conducted with DOD officials as well as an examination of applicable OSD, JSC, and Navy documents [Refs.10, 12, 20, 21, 22, 28]. Reference to classified material has been avoided in order to preserve the unclassified nature of this thesis.

the JLREID and JLRSS in order to make them more useful to long-range planners. The orientation of the revised JLREID is toward a strictly qualitative appraisal of trends which are likely to affect world power relationships, with particular emphasis on associated conflict possibilities. The JLRSS, on the other hand, is being given a more quantitative flavor through the use of environmental forecasting techniques based on regression analysis. While it is too early to assess the real value of these changes, the mere fact that efforts are underway to develop more viable and useful documents is encouraging.

The Navy, on the other hand, has virtually abandoned its effort to produce or update the Navy Strategic Study. Instead, several special-purpose strategy projections have been developed. One of the most comprehensive of these is Project 2000 which was recently published at the direction of the CNO. Its purpose is to examine the trends which are most likely to affect the shape of the Navy through the last quarter of the twentieth century. Almost exclusively qualitative in nature, it is based on the projection of an environment in which world power relationships remain approximately as they exist today. While this study represents a valuable and pragmatic approach to long-range planning of naval forces, the fact that its conclusions are predicated on a single set of assumptions limits its usefulness in a dynamic environment. Consequently, there also exists a need for a more versatile type of forecast which reflects the sensitivity of the naval warfare environment to changing conditions.

B. ASSESSMENT OF FORCES

Assessment capabilities, at both the OSD and OPNAV levels, have been markedly enhanced in the last few years. Prior to 1970, DPPG guidance provided for assessments and force planning to be accomplished under the assumption that the U.S. would be involved in $2\frac{1}{2}$ wars simultaneously (i.e. major conflicts with both the USSR and the PRC plus a brush-fire engagement). Since this "worst case" assumption resulted in assessments which indicated an unrealistically weak force posture, the guidance was changed to provide for the use of a $1\frac{1}{2}$ war scenario. This was still an extremely pessimistic assumption, however, which did not provide much latitude for an examination of force posture trade-offs. Consequently, the guidance was again revised in order to delineate six different scenarios which are relevant for planners of general-purpose forces:

1. A full-scale war with the USSR in the NATO region.
2. A major conflict in Asia involving U.S. defense of allies against PRC aggression.
3. Unilateral military action by the U.S., not involving direct confrontation with the USSR or PRC.
4. A limited confrontation with the USSR outside NATO.
5. Protection of maritime security.
6. Adequate peacetime "presence" forces.

While the first three scenarios are practically the same as those included in the $2\frac{1}{2}$ or $1\frac{1}{2}$ war guidance, separating them and adding the last three scenarios provides much more

flexibility in that they can be utilized individually or in combination, according to the needs dictated by specific situations. Although more detailed specification will be required in order to provide a truly uniform basis for force planning trade-off decisions, the delineation of these six individual scenarios is a definite step in that direction.

Another important innovation was the creation of special panels dedicated to the task of developing assessments at both the OSD and OPNAV levels. These groups are charged with the responsibility for performing "a comparative analysis of those military, technological, political, and economic factors which impede or have a potential to impede our national security objectives, with those factors available or potentially available to enhance accomplishment of these same national security objectives" [Ref. 21]. While the OSD net assessment organization is still in the formative stages, its Navy counterpart has already had an impact on planning activities. Situated within the Office of Navy Program Planning (OP-090), this group has several important functions. Besides being the central clearing house for all Navy assessment activities (e.g. the SEAMIX Study Group), it is responsible for updating the CNO Net Assessment of the United States and Soviet Navies as well as performing other assessments independently and in conjunction with OSD (e.g. The Navy Missions Study). As it matures, this organization should provide the direction for Navy assessment activities that was so sorely deficient prior to 1973.

C. ANALYSIS OF DEFICIENCIES

Another aspect of the revised DPPG and CPPG is noteworthy at this point. It was realized that the traditional guidance was not adequate for long-range force planning purposes due to its relatively short (eight-year) horizon. Consequently, the DPPG and CPPG have been augmented by an Extended Planning Annex (EPA) and Extended Planning Guidance (EPG) respectively. These extensions lengthen the guidance horizon by ten years in order to provide a common framework for long-range planning throughout the Navy and DOD. In addition, the CPAM development process was broadened to give explicit attention to the long-range R&D issues which had previously been excluded by the eight-year planning horizon.

With the advent of improved guidance and greater program visibility at the CNO and SECDEF levels, the individual mission sponsors have been given a more clearly defined role in the force planning process. Since assessments are now performed on a coordinated basis and the results are promulgated via specific planning guidance, the individual mission sponsors are no longer in a position to perceive deficiencies solely on the basis of their own force projections. Hence, their current role is mainly to analyze the CNO-perceived deficiencies which are applicable to their areas of responsibility and to determine appropriate means for correcting them. The results of these analyses are delineated in Force and Mission Sponsor Plans (e.g. The Surface Warfare Plan) which have become the formal bridge between force planning and R&D planning.

The R&D planning system itself has been totally revised by OPNAVINST 5000.42, "Weapon Systems Selection and Planning" in an attempt to eliminate the numerous documentation problems described in the last chapter. While the system continues to be composed of document exchanges between OPNAV and NAVMAT, the number of documents has been decreased and their format has been greatly simplified and abbreviated. The objective of the revision was to retain the advantages of the informal dialogue which had been established without sacrificing the review and control attributes of a formally documented process. The initial documents in the new procedure are the Science and Technology Objectives (STO). These replace the GOR's and are designed to focus early R&D efforts on the long-range needs and problems delineated in the Force and Mission Sponsor Plans.

At the JCS level, the joint perspective for the focus of R&D is accomplished by the recently revised JRDOD. Dissatisfied with the JRDOD's reputation as a mere interweaving of individual service initiatives, its originators determined to strengthen it as a tool in support of SECDEF decision-making. The principal thrust of the revision is the addition of priorities among recommended R&D objectives plus indicators of relative importance among ongoing R&D programs. While these rankings primarily reflect service preferences at the present time, they are a start toward an objective joint perspective on the relative value of competing development proposals.

In DDR&E, efforts are also underway to provide better orientation of R&D through higher visibility of competing alternatives. In response to recommendations by the DSARC Weapons Systems Cost Reduction Working Group, the ACP's have been augmented by a new set of documents known as Mission Concept Papers (MCP). These papers are designed as planning documents to provide OSD officials with an understanding of the broad functional and fiscal context into which proposed systems must fit during their life cycle. They are intended to be similar to ACP's but expanded in scope to include threat assessments, deficiency projections, and resource availabilities. Pilot papers have already been written for the missions of Strategic Offense, Continental Air Defense, and Theater Air Defense. While it is not possible to accurately assess their usefulness at this time, the consensus within DOD appears to be that they are too broad in scope to be valuable tools in the DSARC decision-making process.

Another effort at the OSD level which has apparently achieved limited success is the reorientation of the SECDEF and DDR&E Posture Statements to Congress. In response to Commission on Government Procurement recommendations, these statements have recently given more emphasis to long-range projections in order to provide Congress with a better understanding of the rationale behind DOD R&D requirements.



D. SYNTHESIS OF ALTERNATIVES

Returning to the discussion of the revised Navy R&D planning system, the synthesis of alternative system concepts in response to Science and Technology Objectives is now delineated by NAVMAT in a new document called Navy Advanced Concepts (NAC). This document is an outgrowth of the Navy Technological Projections and replaces it in the revised procedure. Its purpose is to outline various Advanced System Concepts (ASC) as an aid to OPNAV sponsors in refining their perceptions of need.

When the sponsor is able to define the specific performance parameters needed, and these parameters are considered by NAVMAT to be within the state-of-the-art, an Operational Requirement (OR) can be issued. This document is similar in purpose to its predecessors, the TSOR and SOR, but it is performance oriented and limited to three pages in length in order to avoid the tremendous publication problems that plagued the previous procedure. Together, the OR's and STO's comprise the Navy R&D Plan which is administered by the Director, RDT&E (OP-098) as the central repository of Navy R&D planning guidance.

When an OR is promulgated by OPNAV, NAVMAT responds with a Development Proposal (DP) as the final document in the new R&D "user-producer" exchange. This document, the successor to the old PTA's and TDP's, outlines the range of viable alternative solutions to an OR and highlights applicable cost/performance trade-offs.

AT the OSD level, two important refinements to the synthesis portion of the requirements determination process have recently emerged. First, the TCP's have proved to be a highly useful tool for illuminating R&D capabilities and problems on a DOD-wide basis. Second, the DDR&E Posture Statement to Congress has effectively implemented the Commission on Government Procurement's recommendation concerning the delineation of ongoing R&D programs by mission area rather than appropriation category. The statement in support of the FY75 RDT&E budget request clearly delineated the impact of current development programs in both a mission and appropriation context.

E. EVALUATION OF CONCEPTS

This last functional division of the process has experienced almost as much change in the last two years as any of those previously discussed. Within the Navy, an Acquisition Review Committee (ARC) has been established as a sub-panel of the CEB to monitor CNO-designated programs which are below DSARC review thresholds. All OR's which fall in this category, as well as the more major ones, must be validated by the CEB/ARC prior to promulgation. When an approved OR and its corresponding DP have subsequently defined the relevant system alternatives, a Navy Development Concept Paper (NDCP) is drafted and reviewed by the CEB/ARC for the purpose of designating the CNO-preferred alternative and authorizing commencement of the conceptual development phase. After conceptual efforts are completed and the program is ready to

enter the validation phase, a DCP is drafted and submitted to the CEB/ARC. If approved, it proceeds to the Department of the Navy Systems Acquisition Review Council (DNSARC), composed of SECNAV and his Assistants plus the CNO and the Commandant of the Marine Corps. This body has the responsibility for providing the final pre-DSARC program validation and establishing the Department of the Navy position on the development alternatives. While this three-stage review process within the Navy should markedly improve control capabilities, there exists a very real danger that it may also serve to eliminate viable alternatives before the DSARC program initiation review is convened.

The OSD level review procedure is also being refined with the development of DODI 5000.2, "The DCP and the DSARC." This instruction will delineate, for the first time, exactly what information should be contained in the DCP and what criteria are to be used at the three DSARC program reviews. While most of this information has been generally known and accepted for quite some time, it has not yet been given official recognition.

In summary, the many changes which have been instituted in the requirements determination process during the 1973-74 time frame can be grouped into the three categories mentioned in the last chapter: direction and coordination; execution and documentation; review and control.

The improvements in the direction and coordination area have been implemented primarily at the CNO and SECDEF levels.

They consist of more thorough and extended guidance through the DPPG and CPPG, as well as increased staff support for the functions of comparative force assessment and mission deficiency analysis. Execution and documentation improvements, on the other hand, have occurred mostly at the working level and have involved sophistication of procedures and simplification of documents. Finally, review and control have been enhanced by efforts to ensure higher visibility at intermediate stages in the process for the benefit of Congress as well as CNO and SECDEF.

The revised process, as discussed in this chapter, is summarized in figure 5. It is interesting to note that this figure is, in most respects, very similar to figure 4 (i.e. the pre-1973 process) notwithstanding the many changes which have occurred. The reason for this phenomenon lies in the fact that most of the problems delineated in the last chapter were viewed within DOD as the result of inadequate procedures rather than incorrect ones.

VI. CONCLUSIONS

A. SUMMARY OF ANALYSIS

This analysis has traced the evolution of the requirements determination process for major naval weapon systems during the 1970-74 time frame. The combination of a functional model developed by this author and an organizational model developed by the Commission on Government Procurement was used as a prescriptive baseline for the purpose of evaluating actual DOD/Navy procedures. It was determined that the procedures in effect prior to 1973 paralleled the baseline functionally, but not organizationally, and three major problem areas were noted. First, guidance and coordination of the process were sorely lacking, due primarily to the transition from the McNamara philosophy of centralized control to the Laird-Packard philosophy of participatory management. Second, execution and documentation suffered from both uncertainty difficulties and inflexible procedures. Third, review and control were degraded by the inadequacy of the analytic support available to decision-makers and by the numerous bureaucratic constraints endemic to any large organization such as DOD.

As a consequence of the interest and visibility generated by publication of the Report of the Commission on Government Procurement, internal DOD studies of the major problem areas began to result in extensive procedural changes by 1973. The guidance from SECDEF and CNO was made both more comprehensive

in scope and extended in horizon, in an effort to provide positive direction to the process. Assessment capabilities at both the OSD and OPNAV levels were strengthened in order to establish a uniform basis for the analysis of specific mission deficiencies. Extensive efforts at the working levels were initiated to develop new methodologies for dealing with uncertainty and to provide a simplified, performance-oriented approach to "user-producer" communication and documentation. Finally, analytic tools at the CNO and OSD levels were refined in order to improve control capabilities, and congressional briefings were reoriented in an effort to enhance the legislators' understanding of DOD planning rationale.

B. PROGNOSIS AND RECOMMENDATIONS

While it is much too early to make any definitive prediction concerning the real adequacy of these procedural changes, it is possible to analyze their apparent value. By the standard of the prescriptive baseline, the current process appears to be complete in both a functional and an organizational context. It may be concluded, therefore, that the new procedure can, but not necessarily will, correct the major problems which plagued the pre-1973 process. The mere existence of comprehensive and workable procedures does not by any means guarantee that the requirements determination process will be any better or more efficient in the future than it was in the past. None of the diverse political and bureaucratic forces that degraded the effectiveness of the

previous process have been eliminated. In fact, they will most likely become stronger as the competition for resources within DOD becomes more intense. It is, therefore, mandatory that direction and control of the process be further developed at both the SECDEF and CNO levels. Such action requires that assessment and analysis capabilities continue to be strengthened. While the Navy efforts in this area appear to be sufficient, it is not clear that the same is true for OSD. DDR&E has experienced very little success in its attempts to provide SECDEF with coordinated analyses of long-range defense requirements and corresponding R&D programs. Likewise, the JCS planners have met with many difficulties in overcoming their reputation for mere interweaving of service-submitted initiatives. Consequently, the long-range analytic base for decisions at the SECDEF level has been, and continues to be, undesirably weak.

The Assistant Secretary of Defense for Program Analysis & Evaluation (ASDPA&E) is the SECDEF's principal repository of analytic support. For the past several years, the influence of this Office has been greatly diminished as a result of the mistakes attributed to it during the McNamara-Enthoven era. Under the current administration, it has begun to regain stature and take a more active role in the SECDEF decision-making process. If SECDEF is to receive the scope and depth of analytic support required for effective long-range orientation of defense programs, the role of ASDPA&E in the analysis phase of requirements determination

process should be expanded. Like its counterpart at the CNO level (OP-96), it should be made the focal point for all assessment and analysis activities in support of both the SECDEF guidance for long-range force planning and the DSARC program initiation reviews. While some critics may contend that such action would impinge on the prerogatives of DDR&E, it is this author's conviction that technical functions are the appropriate province of scientists and engineers, but analysis should be performed by analysts. It is, therefore, suggested that the development of needs-oriented documents (e.g. ACP's and MCP's) should be a function of ASDPA&E rather than DDR&E.

In conclusion, the requirements determination process has been substantially altered by the changes instituted in the last two years. The revised process appears to be in accord with the prescriptive baseline developed in this thesis. If it is to succeed in practice as well as on paper, however, it will be necessary that each of the participants cooperate in making it work. Since the existence of fierce competition for resources among services and mission sponsors tends to inhibit such cooperation, objective and comprehensive analyses in support of decision-making at the CNO and SECDEF levels are absolutely vital.

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